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Dynamics of Pulse Production in North-East Region of India- A State-wise Analysis

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ABSTRACT

Per capita consumption of pulses over the years has come down to 30g/day in 2008 from 61g/day in 1951. The same trend is followed in North Eastern part of our country. Pulses are mainly grown in uplands in North Eastern Hill Region of India. Pulses are very important for achieving nutritional security and considering its importance the 68th UN General Assembly declared 2016 the International Year of Pulses (IYP). Depending on the size of the farm land and their resources, pulses are grown by the farmers. In 2013-14, NE India produced 209.3 thousand tonnes of pulses from an area of 252.8 thousand hectare with an average productivity of 828 Kg/ ha. The NE region of India is almost 82% deficit in pulse production against its requirements as per ICMR recommendation. The study revealed that during overall period (1972-73 to 2011-12), across all the states in North East Region, Manipur (28.3%) has registered the highest significant growth in production followed by Nagaland (11.9%) and Tripura (4%). From decomposition analysis of growth in North East, it was found that over the period (1972-73 to 2011-12) yield effect (48%) was more than area effect (23%) whereas in country level area effect (33.8%) was more than yield effect (28.3%). There is a need for concerted efforts from various Departments to divert the area under shifting cultivation to production of pulses and other crops following principles of conservation agriculture, which would ultimately help in conserving soil and improving health.

Keywords: North-East, pulse, yield, growth rate, per capita consumption

India has achieved 19.25 million tonnes of pulse production from an area of about 25.2 million hectare during the year 2013-14 (DAC, MOA & FW, GoI). However, the per capita availability of protein is 28g/day which is much lower than the FAO recommended level of 80g/day (Nagy *et al.* 2013; Prasad *et al.* 2013; Saroj *et al.* 2013). Per capita consumption of pulses over the years has come down to 30g/day in 2008 from 61g/day in 1951 (Reddy, 2009). The same trend is followed in the North Eastern part of our country. Considering the importance of pulses to achieve nutritional security, the 68th UN General Assembly declared 2016 the International Year of Pulses (IYP). Pulses are mainly grown in the uplands in the North Eastern Hill Region of India. The agricultural production system in North- Eastern Region (NER) is characterized by a large CDR (Complex diverse risk prone) type, low cropping intensity, subsistence farming, undulating topography and faulty land use pattern with an annual loss of soil of 46 t/ha. The major pulses grown in NE India are green gram (*Vigna radiata*), black gram (*V. mungo*), pigeon pea (*Cajanus cajan*), cowpea (*V. unguiculata*), french bean (*Phaseolus vulgaris*), chickpea (*Cicer arietinum*), lentil (*L. culinaris*) & field pea (*Pisum sativum*). In hills, other beans such as faba bean (*V. faba*), adzuki bean (*Vigna angularis*), moth bean (*V. aconitifoloia*) and broad bean (*Dolichos lablab*) are also used as pulses. The primitive system of shifting cultivation is practiced widely in all the states of North East, except Sikkim. The cropping system can more precisely be described as relay mixed cropping as crops are sown in the same field before the harvest

of the previously sown mixed crops in the same field. Depending on the size of the farm land and their resources, pulses are grown by the farmers. In 2013-14, NE India produced 209.3 thousand tonnes of pulses from an area of 252.8 thousand hectare with an average productivity of 828 Kg/ ha. The NE region of India is almost 82% deficit in pulse production against its requirements as per ICMR recommendation. Closing the gap between demand and the supply of pulses would require production to grow at least by 4 per cent per annum (Kumar, 1998; IIPR, 2011). Pulse production has been given more emphasis under the National Food Security Mission (NFSM) but still more efforts are required to feed our own population. Under this scenario, the present paper has studied the Dynamics of Pulse Production in the region at the state level.

Data and Methodology

Secondary data on area, production and productivity of different crops were compiled from Ministry of Agriculture, Govt. of India. The methods used in the study included the estimation of growth rate with its test of significance, decomposition of growth components, confirmation of acceleration, deceleration or stagnation of growth and instability analysis.

Growth Rate Estimation

The growth rate was measured following the procedure adopted by various authors, Mahir *et al.* (2010), Sonnad *et al.* (2011), Kenamu *et al.* (2014). By taking time as the independent variable and area, production and productivity of the crops as the dependent variables, the compound growth rates were estimated.

$$Y = A\,(1 + r)^{t}$$

Where,

Y-denotes the dependent variables like area, production and productivity in the year 't'.

A-is a constant

R-is the rate of annual increment.

The significance of growth rate was tested by applying students 't' test statistic.

Decomposition of Growth Components

The technique of decomposition has been adopted to measure the relative contribution of area and yield towards the total production change with respect to individual crop. The change in the production of crop between any time periods has been measured as,

Change in Production = Yield Effect + Area Effect + Interaction Effect

Thus, the total change in production is attributed due to area and yield that can be decomposed into three effects *viz.* yield, area and interaction effects.

RESULTS AND DISCUSSION

Status and Dynamics of Pulse Production

The present status of pulse production in the states of North-East region is presented in Table 1 with the latest data available for the year 2013-14.

Table 1: State-wise area, Production and Yield Pulses in NER, (2013-14): (Area '000 Hectare, Production '000 Tonnes and Yield Kg/Ha)

States	Area	Production	Yield
Arunachal Pradesh	9.70	11.2	1149
Assam	150.1	104.3	695
Manipur	29.9	27.9	933
Meghalaya	2.9	3.2	1092
Mizoram	3.9	05.7	1468
Nagaland	37.8	42.5	1124
Sikkim	6.3	05.8	925
Tripura	12.2	08.7	719
Total	252.8	209.3	828

Source: *DAC, Ministry of Agriculture and Farmers Welfare, Govt. of India, 2014-15.*

The total area under pulses in the North-East region was almost 252 thousand hectares of which 58 per cent was in Assam, followed by Nagaland (15%) and Manipur (12%). The total production from the region amounted to 209.3 thousand tonnes with the highest contribution made by Assam (48%) followed by Nagaland (20%) and Manipur (13%). Interestingly, Mizoram having less area under pulses (3.9 thousand ha) showed the highest yield (1468 Kg/ha) among the North-

Eastern States. On the other hand, the yield was the lowest in Assam (695 kg/ha) even though the maximum area was found under pulses. Higher than the regional average yield (828 kg/ha) were found in Arunachal Pradesh, Manipur, Meghalaya, Mizoram Nagalandand Sikkim whereas in Tripura and Assam, the yield of pulses were lower, leaving the future scope for increasing pulse production of the region through productivity increase.

The state-wise dynamics of the total production of pulses in North-East region is presented in Table 2. A perusal of Table 2 revealed that the region requires a total of 874.00 thousand tonnes of pulses for its population of 47.9 million, whereas production was only 159.9 thousand tonnes in the triennium ending 2014 showing 81.72% deficit in pulses production. The per cent increase in production from the triennium ending 2003 to 2014 was the highest in Manipur (825%) followed by Meghalaya (123.82%) and Arunachal Pradesh (46.22%).

However, decrease in production was observed in Assam and Sikkim during the same period. Even though Manipur, Meghalaya and Arunachal Pradesh experienced high growth in production between 2003 and 2014, the states were still 46.85 per cent, 86.61 per cent and 59.2 per cent deficient in pulses production respectively to cater to their populations in 2014. High deficit in pulses production was observed in all the states of the North-East region, the highest being observed in Tripura (91.51%) and the least in Nagaland where it was only 6.4 per cent.

Dynamics of area, production and productivity

To estimate the growth performance of agriculture, time series data on area, production and productivity of pulses for the period 1972-73 to 2011-12 were analyzed. To understand the decadal performance, the whole period was divided into three decades viz. 1982-83 to 1991-92 (I decade), 1992-93 to 2001-02 (II decade), 2002-03 to 2011-12 (III decade) and the overall period 1972-73 to 2011-12.

First Decade(1982-83 to 1991-92)

Data were not available for the states of Arunachal Pradesh, Manipur and Mizoram. The growth rate of yield was found negative in Meghalaya. Positive but non-significant growth rate in pulse area was observed in Nagaland. Positive non-significant growth in yield was also observed in Nagaland. The rate of growth in area was significant at 10 per cent level in Sikkim. In Tripura, the rate of growth in area was significant at 1 per cent level and in case of production it was found positive and significant at 1 per cent level.

Second Decade (1992-93 to 2001-02**)**

Data were not available for the state of Manipur. In Assam, negative growth rate at 10 per cent level of significance was observed. In Mizoram, the growth rate in area was found negative during this time period. In Nagaland, the rate of growth in area was found significant at 1 per cent level. The rate of growth in production was also observed significant at 5 per cent level. However, negative and non-

Table 2: Production and requirement of Pulses in NE Region in 2014

State with human Population in 2014	Production		Increase 2003 to 2014 (%)	Requirement as per 2014 population ('000 tonnes)	Deficit/ Surplus (%)
	TE 2001- 2003 in ('000'tonnes)	TE 2012 - 2014 in('000'tonnes)			
Arunachal Pradesh (14,53,124)	7.40	10.82	46.22	26.52	-59.20
Assam (3,27,58,905)	63.00	61.55	-2.30	597.85	-89.70
Manipur (28,60,566)	3.00	27.75	825.00	52.21	-46.85
Meghalaya (31,15,171)	3.40	7.61	123.82	56.85	-86.61
Mizoram (11,46,656)	4.50	5.49	22.00	20.93	-73.77
Nagaland (20,81,613)	30.40	35.56	16.97	37.99	-6.40
Sikkim (6,38,680)	6.30	5.85	-7.14	11.66	-49.83
Tripura (38,58,255)	5.40	5.98	10.74	70.41	-91.51
Total NE (4,79,12,969)	**123.70**	**159.84**	**29.22**	**874.41**	**-81.72**

Note: *TE = Triennium average.*

Table 3: Compound growth rates of area, production and yield of total pulses in North-East India State-wise during the decades of 1982-83 to 1991-92, 1992-93 to 2001-02, 2002-03 to 2011-12 and overall period1972-73 to 2011-12

Period	Factor	Arunachal Pradesh	Assam	Manipur	Meghalaya	Mizoram	Nagaland	Sikkim	Tripura
1982-83 to 1991-92	Area	NA	1.355	NA	1.228	NA	36.529	13.033*	16.437***
	Production	NA	2.176	NA	1.028	NA	40.529**	11.312	19.491***
	Yield	NA	0.810	NA	-0.198	NA	2.930	-1.523	2.623
1992-93 to 2001-02	Area	0.372	-7.365*	NA	6.124	-5.857	14.437***	-7.568**	-9.090*
	Production	2.611	-6.008*	NA	6.257	-7.850	13.147**	-8.081*	-7.407
	Yield	2.230	1.465	NA	0.125	-2.116	-1.127	-0.556	1.851*
2002-03 to 2011-12	Area	3.630	1.292	21.014***	-1.384	-2.836	0.677	5.765	-2.481
	Production	3.855	1.645	28.306**	1.135	0.629	2.471	5.489	-0.649
	Yield	0.217	0.348	6.026	2.554**	3.566	1.782	-0.261	1.879**
1972-73 to 2011-12	Area	2.263**	0.458	21.014***	3.303***	-0.342	9.482***	-1.518	2.170
	Production	3.351***	1.550**	28.306**	3.937***	-3.302	11.856***	-0.927	4.023**
	Yield	1.064**	1.087***	6.026	0.613*	-2.970	2.169***	0.600	1.814***

Notes: **, ** and *** denote Significant at 10 per cent, 5 percent and 1 percent levels respectively*

significant growth rate in yield was observed. In Sikkim, the rate of growth in area was negative of significance at 5 per cent level. The rate of growth in production was found negative at 10 per cent level of significance during this period. In Tripura, the rate of growth was found negative and significant at 1 per cent level.

Third Decade (2002-03 to 2011-12)

In area and production, maximum growth rate was found in Manipur (21% and 28%) during this period. In Manipur, the rate of growth in area was found positive at 1 per cent level of significance, whereas production was also positive and significant at 5 per cent level. In Meghalaya, the rate of growth in yield (2.5%) was the highest and significant at 5 per cent level followed by Tripura (1.9%). In Mizoram, the rate of growth in area was found negative. In Meghalaya, the only positive rate of growth in yield was observed in this period. In Nagaland, positive but non-significant growth rate in area, production and yield was observed. In Sikkim also, positive but non-significant growth in area was observed.

Overall period (1972-73 to 2011-12)

In Arunachal Pradesh, the positive and significant growth rate in area, production and yield was observed during this period. During the total study period (1972-73 to 2011-12), across all the states in the North East region, Manipur (28.3%) has registered the highest significant growth in production followed by Nagaland (11.95) and Tripura (4%). Except Mizoram, all the States have shown positive growth rate in yield increase. The highest Growth rate in yield was attained by Manipur (6%), followed by Nagaland and Tripura. In Mizoram, the negative growth rate in area, production and productivity was found but not significant at any point of time.

Contribution of Area and Productivity towards Pulse Production

The dynamics of area, production and yield of major pulses revealed the general pattern of growth and the direction of changes in yield and area, but did not evaluate the contribution of area and yield to the nutritional security in the NE region. Therefore, it was necessary to examine the sources of output growth. For this, the change in production was divided into three effects viz., area effect, yield effect and interaction effect. With the help of this additive decomposition model, the relative contribution of area, productivity and their interaction on pulses production in NE states for different periods (1972-73 to 1981-82, 1982-83 to 1991-92, 1992-93 to 2001-02, 2002-03 to 2011-12 and 1972-73 to 2011-12) were estimated and presented in Table 4.

Table 4: Contribution of area, productivity (yield) and their interaction to nutritional security in N-E Region during the decades 1972-73 to 1981-82, 1982-83 to 1991-92, 1992-93 to 2001-02, 2002-03 to 2011-12 and overall period1972-73 to 2011-12

	Arunachal	Assam	Manipur	Meghalaya	Mizoram	Nagaland	Sikkim	Tripura	NE	India
Period I (1972-73 to 1981-82)										
ΔP	NA	9700 (100)	NA	800 (100)	NA	-900 (100)	NA	1200 (100)	14700 (100)	8107300 (100)
$Y_0\Delta A$	NA	-2860.1 (-29.5)	NA	133.3 (16.67)	NA	50 (-5.5)	NA	74.1 (6.17)	-1648.9 (-11.2)	2115676.4 (26.1)
$A_0\Delta Y$	NA	13466.3 (138.8)	NA	571.4 (71.4)	NA	-912 (101.3)	NA	1018.2 (84.9)	16967.8 (115.4)	3710876.8 (45.8)
$\Delta A\Delta Y$	NA	-906.2 (-9.3)	NA	95.2 (11.9)	NA	-38 (4.22)	NA	107.7 (9.0)	-619 (-4.2)	2280746.8 (28.1)
Period II (1982-83 to 1991-92)										
ΔP	NA	43300 (100)	NA	400 (100)	NA	14600 (100)	5500 (100)	6700 (100)	81900 (100)	5565000 (100)
$Y_0\Delta A$	NA	4041.55 (9.33)	NA	109.09 (27.27)	NA	350 (2.4)	417.24 (7.59)	333.93 (4.98)	13850.88 (16.91)	-452518.36 (-8.13)
$A_0\Delta Y$	NA	36467.09 (84.22)	NA	275.86 (68.97)	NA	7600 (52.05)	4724.36 (85.9)	5641.51 (84.2)	55832.27 (68.17)	6254284.02 (112.39)
$\Delta A\Delta Y$	NA	2791.36 (6.45)	NA	15.05 (3.76)	NA	6650 (45.55)	358.4 (6.52)	724.56 (10.81)	12216.85 (14.92)	-236765.66 (-4.25)
Period III (1992-93 to 2001-02)										
ΔP	1800 (100)	-26200 (100)	NA	1100 (100)	-4000 (100)	22200 (100)	-4700 (100)	-4100 (100)	-10800 (100)	-5132400 (100)
$Y_0\Delta A$	755.88 (41.99)	19310.36 (-73.70)	NA	57.45 (5.22)	-2122.22 (53.06)	222 (1)	124.62 (-2.65)	2176.47 (-53.08)	31380.8 (-290.56)	2028040.87 (-39.51)
$A_0\Delta Y$	913.79 (50.77)	-37608.02 (143.54)	NA	1018.18 (92.56)	-2567.5 (64.19)	21346.15 (96.15)	-4766.94 (101.42)	-5116.48 (124.79)	-34220.37 (316.86)	-6453051.74 (125.73)
$\Delta A\Delta Y$	130.32 (7.24)	-7902.33 (30.16)	NA	24.37 (2.22)	689.72 (-17.24)	631.85 (2.85)	-57.67 (1.23)	-1159.99 (28.29)	-7960.43 (73.71)	-707389.13 (13.78)
Period IV (2002-03 to 2011-12)										
ΔP	2800 (100)	8550 (100)	24250 (100)	420 (100)	320 (100)	6660 (100)	-730 (100)	490 (100)	42760 (100)	5963913 (100)
$Y_0\Delta A$	368.42 (13.16)	3567.67 (41.73)	2487.37 (10.26)	823.37 (196.04)	1389.56 (434.24)	4728.99 (71.01)	-188.15 (25.77)	636.44 (129.89)	17128.78 (40.06)	3193341.63 (53.54)
$A_0\Delta Y$	2320.55 (82.88)	4702.70 (55.00)	11122.22 (45.86)	-322.83 (-76.86)	-836.96 (-261.55)	1652 (24.8)	-557.75 (76.4)	-131.25 (-26.79)	22398.98 (52.38)	2152665.95 (36.09)
$\Delta A\Delta Y$	111.03 (3.97)	279.63 (3.27)	10640.41 (43.88)	-80.55 (-19.18)	-232.6 (-72.69)	279.01 (4.19)	15.9 (-2.18)	-15.19 (-3.1)	3232.24 (7.56)	617905.42 (10.36)
Overall Period (1972-73 to 2011-12)										
ΔP	5200 (100)	26050 (100)	NA	2920 (100)	-2580 (100)	33460 (100)	370 (100)	5290 (100)	116260 (100)	13646613 (100)
$Y_0\Delta A$	1110.53 (21.36)	8468. 7 (32.51)	NA	454.94 (15.58)	-2343.86 (90.85)	1527.42 (4.56)	1544 (417.3)	834.11 (15.77)	27044.5 (23.26)	4607916.22 (33.77)
$A_0\Delta Y$	3381.03 (65.02)	14660 (56.28)	NA	1571.43 (53.82)	-335.75 (13.01)	14049.6 (41.99)	-916.67 (-247.75)	2033.18 (38.43)	55817.96 (48.01)	3864977.67 (28.32)
$\Delta A\Delta Y$	708.44 (13.62)	2921.2 (11.21)	NA	893.63 (30.60)	99.61 (-3.86)	17882.98 (53.45)	-257.33 (-69.55)	2422.71 (45.8)	33397.54 (28.73)	5173719.11 (37.91)

Note: *The values within the parentheses are percentage share of Column total (P= Production in '000 tonnes, A= Area in '000 ha, Y= Yield in tonnes/ha, ΔP, ΔA and ΔY are Change in Production, Area and Yield respectively.)*

For some States (Arunachal Pradesh, Manipur and Mizoram), data were not available for the Periods I and II. Area effect had the major contribution in the overall time period considered and also in the Periods III and IV. In Assam, the major contribution was largely from yield effect in all the time periods considered. In Manipur, yield effect had the major contribution in Period IV in growth in the production of pulses. In Meghalaya, with a slight variation, the area effect was the major contributor in Period IV. Before that, the yield effect had been the major contributor in growth in production. For Mizoram state, data were not available for Periods I and II. The change in growth rates in production of pulses had been for various reasons in different time periods, such as yield effect being the major contributor in change in growth rate of pulse production in Period III, area effect being the major one in Period IV and interaction effect being the major one in the overall time period. In Nagaland also there were many variations found between the mentioned time frames. The major contribution was from yield effect in Periods I, II and III. However, it was the area effect in Period IV and the interaction effect in the overall time period which increased production.

In Sikkim, yield effect had the major contribution in Periods II, III and IV. However, area effect had the major contribution in the overall time period. In Tripura, the major contribution was from yield effect in Periods I, II and III, and from area effect for Period IV. In the overall duration of the time period, the major contribution was from the interaction effect. In North- East, it was found that over the period (1972-73 to 2011-12) yield effect (48%) was more than the area effect (23%) whereas in country level area effect (33.8%) was more than the yield effect (28.3%). Rest of the contribution was from the interaction effect.

Instability Indices

Instability in area, production and Productivity continues to be a major concern of the producers and consumers. Various developments in Indian agriculture such as production and productivity enhancing technologies, enhanced exports and the market reforms have positively impacted pulse trading in the recent years. Therefore, Instability Indices were calculated using different time periods.

Period I

During this period, the highest instability in area was observed in Nagaland followed by Tripura and Meghalaya. Similar trend was also observed in pulse production. In case of yield, the highest instability was found in Meghalaya followed by Tripura and Assam. In North-Eastern region, the instability was more in production followed by yield and area.

Period II

In Assam, instability was found more in production followed by area and yield. Among the States, Nagaland had shown highest instability in area followed by Sikkim and Assam. In production also instability was found to be the highest in Sikkim followed by Nagaland and Assam. In yield, Nagaland had shown the highest instability followed by Sikkim and Tripura. In North-Eastern region as a whole, more instability was observed in production followed by area and yield.

Period III

Among the States, Mizoram had shown the highest instability in area followed by Nagaland and Sikkim. In production, instability was found highest in Nagaland followed by Mizoram and Sikkim. In yield, Nagaland had shown highest instability followed by Sikkim and Arunachal Pradesh. In the entire North-Eastern region, more instability was found for area followed by production and yield. In the national level, more instability was observed for both area and production followed by yield.

Period IV

Within the States, Sikkim had shown highest instability in area followed by Mizoram and Manipur. In production, instability was found highest in Manipur followed by Mizoram and Sikkim. In yield, Mizoram had shown the highest instability followed by Manipur and Nagaland. In the entire North-Eastern region, more instability was found in production followed by area and yield. In the national level, more instability was observed in production followed by yield and area.

Overall Period

Among the States, Nagaland had shown the highest instability in area followed by Mizoram and

Table 5: Instability Indices in the Production of Pulses during the Decades 1972-73 to 1981-82, 1982-83 to 1991-92, 1992-93 to 2001-02, 2002-03 to 2011-12 and Overall Period 1972-73 to 2011-12

	Arunachal	Assam	Manipur	Meghalaya	Mizoram	Nagaland	Sikkim	Tripura	NE	India
1972-73 to 1981-82										
Area	NA	0.065	NA	0.139	NA	0.598	NA	0.203	0.057	0.173
Production	NA	0.178	NA	0.197	NA	0.557	NA	0.307	0.164	0.317
Yield	NA	0.135	NA	0.223	NA	0.131	NA	0.186	0.125	0.173
1982-83 to 1991-92										
Area	NA	0.210	NA	0.116	1.166	0.680	0.296	0.163	0.125	0.127
Production	NA	0.238	NA	0.149	NA	0.526	0.562	0.169	0.139	0.120
Yield	NA	0.089	NA	0.070	NA	0.417	0.382	0.118	0.100	0.091
1992-93 to 2001-02										
Area	0.171	0.158	NA	0.171	0.252	0.241	0.181	0.165	0.138	0.130
Production	0.167	0.143	NA	0.168	0.281	0.347	0.212	0.161	0.115	0.130
Yield	0.088	0.049	NA	0.025	0.087	0.204	0.165	0.054	0.052	0.114
2002-03 to 2011-12										
Area	0.076	0.060	0.267	0.094	0.307	0.100	0.313	0.108	0.062	0.077
Production	0.093	0.075	0.408	0.110	0.401	0.202	0.326	0.088	0.073	0.144
Yield	0.029	0.031	0.191	0.045	0.421	0.186	0.048	0.028	0.042	0.082
1972-73 to 2011-12										
Area	0.129	0.141	0.267	0.133	0.275	0.483	0.272	0.172	0.106	0.133
Production	0.132	0.168	0.408	0.157	0.340	0.459	0.387	0.205	0.129	0.193
Yield	0.064	0.083	0.191	0.115	0.296	0.251	0.233	0.112	0.084	0.116

Sikkim. In production, instability was found to be the highest in Nagaland followed by Manipur and Mizoram. In yield, Mizoram had shown the highest instability followed by Nagaland and Sikkim. In the entire North-Eastern region, more instability was found in production followed by area and yield. In the national level, more instability was found in production followed by area and yield

Policy Implications

The study has revealed that during the total study period (1972-73 to 2011-12), across all the states in the North East region, Manipur (28.3%) has registered the highest significant growth in production followed by Nagaland (11.95) and Tripura (4%). Except Mizoram, all the States have shown a positive growth rate in yield increase. The highest Growth rate in yield was attained by Manipur (6%), followed by Nagaland and Tripura. All the states in NE region have shown positive growth rates in area increase except Mizoram and Sikkim. The decomposition analysis of growth has suggested that the sources of output growth were almost the same during all the periods. In North-East, it was found that over the period (1972-73 to 2011-12) yield effect (48%) was more than area effect (23%), whereas in country level area effect (33.8%) was more than yield effect (28.3%).

The fact that productivity of pulses in NE region is higher than that of whole India (According to MOA&FW, 2013-14, average yield of pulses in India is 764 Kg/ ha and NER 828 Kg/ha) suggests for the bright prospects of increasing pulse production from this region. NER is one of the potential areas where pulse production can be increased horizontally by utilizing a part of 1.67 million ha area under shifting cultivation (*Jhum*). Rice and maize fallow may be used for enhancing area under pulses with suitable irrigation facilities.As pulses could be grown mixed with the other crops and are feasible for relay cropping with the other crops, the area and production of pulses could be increased vertically in this region. Usually spring and autumn seasons in this region go as fallow therefore short duration pulses like *mungbean* and *urdbean* offer the opportunity to utilize these seasons. Incorporation of pulses in rice and maize based cropping systems of this region would definitely increase the soil fertility in a sustainable way. Moreover, there is a need for concerted efforts from various departments

to divert the area under shifting cultivation to the production of pulses and other crops following principles of conservation agriculture, which would ultimately help in conserving soil and improving health. Hence, large scale demonstrations and training programmes need to be undertaken at farmers' field level to increase pulse production and make our country, particularly this region nutritionally secure.

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REFERENCES

Dhakre D.S. and Bhattacharya D. 2013. Growth and instability analysis of vegetables in West Bengal, India. *International Journal of Bio-resource and Stress Management,* **4**(3): 456-459.

Kumar Satinder and Singh Surender. 2014. Trends in growth rates in area, production and productivity of sugarcane in Haryana. *International Journal of Advanced Research in Management and Social Sciences,* **3**(4): 117.

Mahir, Mohamed Elamin Abd Ellatif and Hag Hamad Abdelaziz. 2010. Estimation of growth rates and analysis of its components in the Gezira Scheme. *Research Journal of Agriculture and Biological Sciences,* **6**(6): 885-890.

Nagy, K., Sharma, R.N., Nandah, C. and Kanwer, S.S. 2013. Genetic variability and association studies among yield attributes in pigeonpea [*Cajanus cajan* (L.) Millsp.] accessions of Bastar. Proceedings of International Conference on harmony with nature in context of ecotechnological intervention and climate change. National Environmentalists Association, India.

Prasad, Y., Kumar, K. and Mishra, S.B. 2013. Studies on genetic parameters and inter-relationships among yield and yield contributing traits in Pigeonpea [*Cajanus cajan* (L.) Millsp.]. The *Bioscan*., **8**(1): 207-211.

Reddy, Amarender. A. 2009. Pulses Production Technology: Status and Way Forward, *Review of agriculture, Economic & Political Weekly*, **44**(52): 73.

Rehman, Fasih U.R Saeed, Ikram and Salam, Abdul. 2011. Estimating growth rates and decomposition analysis of agriculture production in Pakistan: Pre and post sap analysis. *Sarhad Journal of Agriculture,* **27**(1): 125-131.

Saroj, S.K., Singh, M.N., Ravindra Kumar, Tejveer Singh and Singh, M.K. 2013. Genetic variability, correlation and path analysis for yield attributes in pigeonpea. *The Bioscan*., **8**(3): 941-944.

Sonnad J.S., Raveendaran N., Ajjan, N. and Selvaraj, K.N. 2011. Growth analysis of oilseed crops in India during pre and post - WTO periods. *Karnataka Journal of Agricultural Sciences,* **24**(2): 184-187.